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as 9,450,000 tons; while Mr. Lord, for the same year in Illinois, gives 9,115,653 tons. Coal is mined in forty-nine counties in Illinois; and the number of mines is 639, employing nearly 24,000 men and a capital of \$10,396,540. The production was 10,508,791 tons for 1883, valued at \$15,310,521. This was an increase of 1,393,414 tons over the output of 1882. The average value per ton of the coal at the mines has been \$1.46 for the past three years. There has been a marked decline since 1870, when it was \$2.32.

The report gives a statistical summary for the state; the complete statistics of each county arranged in alphabetical order; and a comparative table for 1882 and 1883, showing the number of men employed, the product in tons, and the average and aggregate values.

There are also papers on 'Miners' wages,' and 'Casualties in mines;' and a detailed description of 'the Diamond-mine disaster at Braidwood,' with a diagram of the mine, is given. The subject of state legislation in the interest of the miners is considered, and statistical tables of the various inspection districts are presented, illustrated by a map showing their boundaries. These are followed by a list of the railroads in the state on the lines of which coal is found, with the names of the towns and stations on each where it is mined and shipped.

The average wages received by the miners is stated to be ninety cents per ton. During the year, 365 casualties occurred, involving the loss of 134 lives. This was at the rate of one for every 78,424 tons of coal, or one man in every 146 employed under ground. The catastrophes at Braidwood and Coultersville, in which 79 lives were lost, of course swells the list, and makes it exceptional; but, leaving them out, one life was lost for every 192,887 tons of coal taken out, which is an excessive death-rate for mines as free from explosive gases as the mines of Illinois are. In the bituminous mining-region of Pennsylvania the average for 1882 was one death to every 277,124 tons of coal mined; and in Great Britain the statistics for eight years, ending with 1880, show that for every 143,667 tons of coal taken out there was an average of one death.

In the Illinois mines the larger number of the miscellaneous accidents are caused by the falling of the roof, against which, as the report says, the miners are usually able to protect themselves. Familiarity with the danger, however, leads them in many cases to neglect the setting of props. Twelve of the 365 accidents were due to gases.

The report concludes with an enumeration of the state mining-laws.

Although residents of Illinois will be especially interested in this report, there is a great deal of material in it that is of general interest and practical value.

#### CARPENTER'S ENERGY IN NATURE.

*Energy in nature: six lectures upon the forces of nature and their mutual relations.* By W. L. CARPENTER. London, Cassell, 1883. 15+212 p., illustr. 12°.

WHEN a man has been driving a butcher-wagon, or throwing trunks, or wading about in the cold and wet all day, and has no attractive fireside to retreat to in the evening, it must be comforting to find a well-warmed and brightly lighted hall standing open, with a platform at one end loaded with bright apparatus, and curiously colored diagrams on the walls.

The weary man walks in and takes his seat among a crowd of equally curious men, or only equally weary if *habitués*, and after rubbing his hands, and smoothing his hat across his knees, gives a few furtive glances at the lecture-table, and awaits events.

Over the uppermost diagram there is posted in the boldest letters, 'Energy in nature.' Our tired friend has a flickering thought that it might be well if there were no energy in nature. With Nature he was acquainted when a boy, possibly, and has a certain system of philosophy in regard to her workings. He once saw a man who could discover springs of good water by means of an apple-twigs. He has leaned his head against telegraph-poles to hear the despatches, or has watched for them as they passed on the wire. He has always been taught that each 'new moon' is a new moon, and, to the best of man's knowledge, made of some common substance necessarily. He is not aware that any of these cherished notions are to be jarred this evening; and, thanks to sooth-ing sleep, they may not be.

The lecturer appears,—a man well acquainted with the mechanical theory of heat, the kinetic theory of gases, the peculiarities of a magnetic field, and the working of an induction-balance, brilliant results of the labor of man,—and has come this evening to flash these jewels before the eyes of his motley audience.

The lecturer begins; and the listeners catch 'electricity,' 'heat,' 'sand,' 'wood.' Two close their eyes and nod (the 'regulars' have already closed their eyes and nodded). 'Energy is the power of doing work,' the lecturer

says: the sleeper opens an eye. 'Force is simply the expression of the rate or speed at which any change takes place in matter:' the eye closes.

The lecturer, building his hopes on the staring eyes of a young man in the front row and the rapidly running pencil of the young woman in the second, dilates upon the first two laws of motion, and approaches the third. He notices a frightened look in the young man's face, and that the pencil has stopped, and says, "Action and reaction are equal, but for present purposes it need not be here discussed."

It may be said that the book-binder's apprentice over the clock has been omitted from this account of the audience. That is very true; but it must be understood, when a popular lecture is given, that it passes right over the heads or through the heads of nearly all who are there; that the results are only to be found in the minds of a stray few. With this granted, one may acknowledge that the blue lights and red lights of the experiments may draw applause, but that the main result of the evening will be a restless sleep for the majority, and a pleasant pastime for a few.

With the fire of the experiments buried in the black and white of woodcuts, and the awakening influence of the speaker's voice gone, the same half-told facts appear weak when read from the pages of a book.

Mr. Carpenter states in his preface, that kind friends advised the publication of his lectures; but the lectures being of the class which hint at rather than discuss the problems of physics, and intended to lead the listener to think he is learning when he is only listening to pleasant chat, it would seem that this advice must have been of the kind which is not meant to be followed.

#### SOME STATE AGRICULTURAL EXPERIMENT-STATIONS.

*Annual report of the Connecticut agricultural experiment-station for 1883.* Printed by order of the legislature. New Haven, Tuttle, Morehouse, & Taylor, pr., 1884. 120 p. 8°.

*Fourth annual report of the New Jersey state agricultural experiment-station for the year 1883.* Vineland, Wilbur pr., 1883. 112 p. 8°.

THE report of the Connecticut station for 1883 presents a good illustration, both of the value of experiment-stations and of the rather narrow limits within which their activity has been in most cases thus far confined. This oldest of the American stations owed its origin to the demand for an efficient control of the

quality of commercial fertilizers. It was in its inception, and has remained to a large extent, a fertilizer-control station; and this, not from any lack of interest in the problems of agricultural science, nor from any incompetence on the part of its officers to solve them, but simply from force of circumstances.

During the winter of 1882-83 the station was without laboratory facilities, and the present report covers about nine months of work. Of its hundred and twenty pages, about seventy are devoted to fertilizers, two hundred and nineteen analyses of which are reported. "Nearly one-half of them are samples of complex composition, each one requiring six determinations in duplicate." The amount of work which this involves can be fully appreciated only by a chemist, but its effect in limiting the amount of other work done is obvious.

Aside from fertilizer analyses, we find in this report numerous tests of the vitality of seeds, together with a description of a new and convenient form of apparatus for the same; analyses of feeding-stuffs, and a table of the composition of American feeding-stuffs compiled exclusively from American analyses by Dr. E. H. Jenkins; analyses of the milk of Ayrshire cows, and of market milk; analyses of oak and chesnut leaves at different periods of growth; and divers minor matters, including notes on some analytical processes.

It will be seen, that, while considerable work other than fertilizer analysis has been done, it is all, so far as reported, laboratory work. Of experiments with living plants or animals, or even with the soil from which they draw their sustenance, we find no mention. As we have already said, this fact is largely, if not entirely, the result of unavoidable circumstances. We mention it here, not to find fault, but to express the hope, that, with its new equipment and increased income, the Connecticut station will find means and opportunity to enlarge the scope of its work, and attack some of the numerous problems in what we might call applied biology, which are waiting solution.

The report of the New Jersey station shows points of resemblance to, and of difference from, that of the Connecticut station. As in the former case, the largest draught upon the resources of the station has been for the analysis of fertilizers, a hundred and ninety-four of which have been examined. Unlike the Connecticut station, the New Jersey station had ready to its hand tolerably good facilities for conducting field and feeding experiments;